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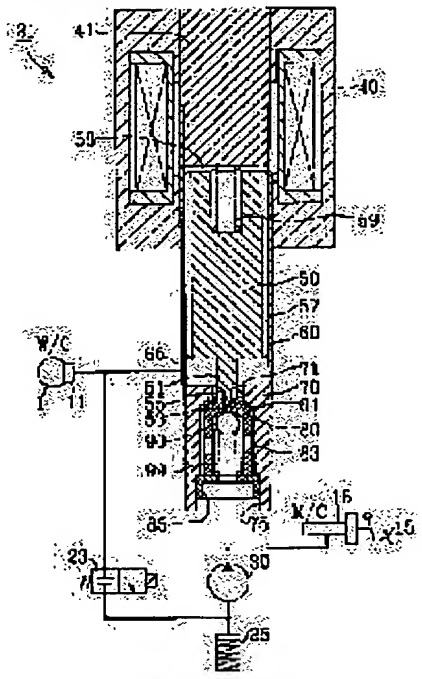
(54) SOLENOID VALVE AND BRAKE CONTROL DEVICE EQUIPPED THEREWITH

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a solenoid valve capable of retaining its structure in a small size and simple while realizing a half opening state.
SOLUTION: This solenoid valve can realize a fully opening state that both a main communicating passage 71 and a throttle communicating passage 81 are communicated and a fully closing state that both these communicating passages 71, 81 are disconnected, and besides, can realized a half opening state which is effective in a point for preventing pulsation and so on, namely, the main communicating passage 71 is disconnected however, the throttle communicating passage 81 is communicated, while the solenoid valve realizes the half opening state by utilizing differential pressure ΔP (=Pm-Pw) between master cylinder pressure Pm and wheel cylinder pressure Pw which are generated during the fully closing state, and further, for realizing this half opening state, energization to a solenoid 40 is not necessary. Therefore, application of energization to the solenoid 40 is not necessary by separating electromagnetic force for the half opened state from electromagnetic force for the fully closing state (that is, a current value supplied to the solenoid 40) as in the conventional case, and simple control can be adopted that energization is simply applied or not to the solenoid 40.



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CLAIMS

[Claim(s)]
[Claim 1] In the solenoid valve arranged in the duct between a brake fluid pressure generating means to generate brake fluid pressure at the time of car braking, and a wheel damping force generating means to generate wheel damping force by said brake fluid pressure The main valve which has the main valve object which can be opened and closed except for said drawing free passage way for the main free passage way which is equipped with the drawing free passage way which extracts the passage of said duct, moves in the predetermined direction, and opens said duct for free passage, The auxiliary valve which moves in the predetermined direction which is the migration direction of said main valve object, and has the auxiliary valve object which can open and close the drawing free passage way of said main valve object, The open position corresponding to the full admission condition of energizing said auxiliary valve, energizing an aperture and said main valve object for said drawing free passage way, and opening said main free passage way, Between the closed positions corresponding to the close-by-pass-bulb-completely condition which energizes neither said main valve object nor an auxiliary valve object according to the elastic operation to the predetermined direction which are a movable valve element energization member and the migration direction of said main valve object The 1st elastic member which energizes said valve element energization member so that it may go to said open position from said closed position, An electromagnetic-force grant means to give the electromagnetic force which the energization force by said 1st elastic member is overcome [electromagnetic force], and makes said closed position maintain said valve element energization member, When said valve element energization member is in said closed position, according to the elastic operation to the predetermined direction which is the migration direction of said main valve object The 2nd elastic member which energizes said main valve object through the auxiliary valve object concerned, and closes said main free passage way while energizing said auxiliary valve object and closing said drawing free passage way, In a preparation and the condition that electromagnetic force is not given by said electromagnetic-force grant means, further Although said main valve object is energized by said differential pressure and said main free passage way is closed when differential pressure with low brake fluid pressure is acting on said main valve object and an auxiliary valve object relatively [said brake fluid pressure generating means side] relatively [said high brake fluid pressure and wheel damping force generating means side] So that said auxiliary valve object will be in the half-opening condition of it being energized by said valve element energization member, and opening said drawing free passage way, and it may be in said full admission condition, when said differential pressure is not acting The solenoid valve characterized by setting up the energization force (henceforth the "differential pressure energization force") over the energization force by said 1st elastic member and 2nd elastic member, the electromagnetic force given by said electromagnetic-force grant means, said main valve object by said differential pressure, and an auxiliary valve object.
[Claim 2] The differential pressure energization force of acting on said main valve object which closes said main free passage way in said half-opening condition Set up in consideration of the minimum value of said differential pressure, and, on the other hand, the differential pressure energization force of acting on said auxiliary valve object which opens said drawing free passage way in said half-opening condition So that it may set up in consideration of the maximum of said differential pressure, said differential pressure energization force may multiply the projected net area of said main valve object and an auxiliary valve object by differential pressure and it may become said set-up differential pressure energization force The solenoid valve according to claim 1 characterized by setting up the projected net area of said main valve object and an auxiliary valve

object.
[Claim 3] Said valve element energization member is prepared at the head of the shaft section inserted in said main free passage way, and the shaft section concerned. In the half-opening location in the middle of having the cylindrical height inserted in in said drawing free passage way of said main valve object, and moving to said open position from said closed position It is the solenoid valve according to claim 1 or 2 characterized by being constituted so that said main valve object may be energized in said shaft section if said main valve object is not energized but it moves to an open position further although said auxiliary valve object is energized in said cylindrical height and said drawing free passage way is opened, and said main free passage way may be opened.

[Claim 4] Said main valve object is a solenoid valve according to claim 1 to 3 with which said 2nd elastic member which is constituted by tubed and energizes said auxiliary valve object and its auxiliary valve object is characterized by being arranged to the tubed main valve inside of the body.
[Claim 5] By preparing said valve element energization member in the plunger of the magnetic substance in one, giving electromagnetic force, attracting said plunger and contacting a stopper with said electromagnetic-force grant means A solenoid valve given in any of claims 1-4 which are constituted so that said valve element energization member may be maintained by said closed position, and are further characterized by infixing the member of non-magnetic material in the field where said plunger contacts said stopper.
[Claim 6] It is the solenoid valve according to claim 5 characterized by preparing the member of the non-magnetic material so that said plunger may become closer to said stopper than other parts of the fields which counter said stopper while the member of said non-magnetic material is prepared in a part of field where said plunger counters said stopper.
[Claim 7] [whether wheel-cylinder ** is ****ed with the brake fluid from a pressure source, and] As a fluid pressure control valve which is the brake operating unit which controls wheel damping force by whether this wheel-cylinder ** is decompressed or this wheel-cylinder ** is held, and is used in case said wheel-cylinder ** is ****ed The brake operating unit characterized by having the control means which controls activation and un-performing while adopting said solenoid valve according to claim 1 to 6. [of grant of the electromagnetic force by said electromagnetic-force grant means]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the solenoid valve used for a brake gear etc., and the brake operating unit which adopted the solenoid valve as a fluid pressure control valve which fluctuates brake fluid pressure.
[0002]
[Description of the Prior Art] The brake operating unit which performs the so-called ****** is proposed by making the fluid pressure control valve (an inlet valve being called.) used in case it ****s conventionally with the brake fluid which supplies wheel-cylinder ** from a master cylinder drive in pulse according to electromagnetic force. Although this was carried out by changing the maintenance location which serves as a boost location where passage is opened fully, and a close by-pass bulb completely in an inlet valve, it had become the cause by which the big pressure pulsation to master cylinder pressure or wheel-cylinder ** occurred according to an oil-hammer phenomenon at the time of the change of "boost -> maintenance" or "a maintenance -> boost", and a loud sound was generated.
[0003] Since the standup delay of wheel-cylinder ** arises at the time of the usual braking and it becomes the cause of the effectiveness delay of a brake, a not much small orifice cannot be made to infix with this configuration, although it is possible to infix an orifice in a serial between a master cylinder and an inlet valve in order to reduce this pressure pulsation.
[0004] Then, constituting so that the passage extracted rather than the open position may be formed is indicated by JP,6-213364,A by making a "half-opening location" between an open position and a closed position in the inlet valve itself. The outline configuration of the solenoid valve currently indicated by this official report is explained with reference to drawing 7 .
[0005] As shown in drawing 7 , the valve portion material 118 of this solenoid valve consists of two parts of a valve push rod 127 and the closeout cap 129, the 1st closeout element 128 is constituted by the edge turned to the valve body 122 of a valve push rod 127, and the closeout cap 129 is put on the edge holding the closeout element 128 of a valve push rod 127. And in the cap pars basilaris ossis occipitalis turned to the valve body 122, the closeout cap 129 equipped the outside with the 2nd closeout element 130 which collaborates with the valve seat 125 in the valve body 122, and equips the inside with the 2nd valve seat 131 which cooperates with the closeout element 128 in a valve push rod 127. In addition, also after the 2nd closeout element 130 has been close with the valve seat 125, the drawing hole 132 which opens the valve inlet port 120 and the inside of the closeout cap 129 for free passage is formed at the head of the closeout cap 129. The closeout cap 129 is energized by the return spring 119 in the direction where the 2nd closeout element 130 separates from a valve seat 125. Moreover, the closeout element 128 is energized with the barrier spring 134 of a valve push rod 127 in the direction which separates from the 2nd valve seat 131. In addition, the spring force of the barrier spring 134 is more remarkably [than the spring force of a return spring 119] large, for example, is set up 5 times.
[0006] And this solenoid valve operates as follows. That is, when not energizing, the 2nd closeout element 130 constituted by the closeout cap 129 is raised from the valve seat 125 in the valve body 122. And the valve-opening opening 124 is opened, therefore brake fluid can flow from the valve inlet port 120 to the valve outlet 121. This is an open position.
[0007] On the other hand, when it energizes with the 1st current value, as a result of the closeout cap 129 exceeding the energization force of a return spring 119 and moving to the valve body 122 side, the 2nd closeout

element 130 is close [a valve push rod 127 energizes the closeout cap 129 through the barrier spring 134, and] to a valve seat 125. However, since the closeout element 128 in the closeout cap 129 is separated from the 2nd valve seat 131 as usual with the barrier spring 134 in this case, brake fluid can flow into the closeout cap 129 through the drawing hole 132 at the head the closeout cap 129 from the valve inlet port 120, and can flow to the valve outlet 121 through the radial hole 133. This serves as a "half-opening location."
[0008] Furthermore, when it energizes with the 2nd current value, the closeout element 128 moves to the 2nd valve seat 131 side, and a valve push rod 127 is close in order to exceed and energize the spring force of the barrier spring 134. Therefore, since the drawing connection through the above-mentioned drawing hole 132 is also intercepted and the flow to the valve outlet 121 disappears from the valve inlet port 120, this serves as a "closed position."
[0009]
[Problem(s) to be Solved by the Invention] However, with the configuration given [above-mentioned] in an official report shown in drawing 7 , it must extract to the closeout cap 129 with which the 2nd closeout element 130 other than the Maine passage which can be opened and closed, and which consists of the 2nd closeout element 130 and valve seat 125 is equipped, a hole 132 must be formed, and the drawing passage passing through the inside of the closeout cap 129 must be formed. And since there is the need of also realizing a close-by-pass-bulb-completely condition, the valve structure by the closeout element 128, the barrier spring 134, and the 2nd valve seat 131 grade is arranged in the closeout cap 129, and cutoff also of the drawing passage is enabled.
[0010] Thus, since there is package preparation ****** and the spring force of the barrier spring 134 must make further another valve structure also in the closeout cap 129 as a valve element remarkably larger than the spring force of a return spring 119, there is a problem that closeout cap 129 the very thing will become on a large scale or complicated inevitably. Furthermore, since it is necessary to perform certainly the contact to two closeout elements and a valve seat to realize a close-by-pass-bulb-completely condition, the burden of the maintenance to the contact part etc. also increases. Moreover, the control current value for half-opening locations and the control current value for closed positions are prepared, and since it is necessary to distinguish and use them properly, it also becomes the factor which carries out the cost rise of the configuration for these currents control.
[0011] Then, this invention aims at offering the solenoid valve which can keep the configuration small and simple, and the brake operating unit which adopted the solenoid valve, though it is possible to realize the so-called half-opening condition.
[0012]
[Means for Solving the Problem] The solenoid valve according to claim 1 made in order to attain this object In the solenoid valve arranged in the duct between a brake fluid pressure generating means to generate brake fluid pressure at the time of car braking, and a wheel damping force generating means to generate wheel damping force by said brake fluid pressure The main valve which has the main valve object which can be opened and closed except for said drawing free passage way for the main free passage way which is equipped with the drawing free passage way which extracts the passage of said duct, moves in the predetermined direction, and opens said duct for free passage, The auxiliary valve which moves in the predetermined direction which is the migration direction of said main valve object, and has the auxiliary valve object which can open and close the drawing free passage way of said main valve object, The open position corresponding to the full admission condition of energizing said auxiliary valve, energizing an aperture and said main valve object for said drawing free passage way, and opening said main free passage way, Between the closed positions corresponding to the close-by-pass-bulb-completely condition which energizes neither said main valve object nor an auxiliary valve object according to the elastic operation to the predetermined direction which are a movable valve element energization member and the migration direction of said main valve object The 1st elastic member which energizes said valve element energization member so that it may go to said open position from said closed position, An electromagnetic-force grant means to give the electromagnetic force which the energization force by said 1st elastic member is overcome [electromagnetic force], and makes said closed position maintain said valve element energization member (electromagnetism solenoid), When said valve element energization member is in said closed position, according to the elastic operation to the predetermined direction which is the migration direction of said main valve object While energizing said auxiliary valve object and closing said

drawing free passage way, it has the 2nd elastic member which energizes said main valve object through the auxiliary valve object concerned, and closes said main free passage way. furthermore, in the condition that electromagnetic force is not given by said electromagnetic-force grant means Although said main valve object is energized by said differential pressure and said main free passage way is closed when differential pressure with low brake fluid pressure is acting on said main valve object and an auxiliary valve object relatively [said brake fluid pressure generating means side] relatively [said high brake fluid pressure and wheel damping force generating means side] So that said auxiliary valve object will be in the half-opening condition of it being energized by said valve element energization member, and opening said drawing free passage way, and it may be in said full admission condition, when said differential pressure is not acting It is characterized by setting up the energization force (differential pressure energization force) over the energization force by said 1st elastic member and 2nd elastic member, the electromagnetic force given by said electromagnetic-force grant means, said main valve object by said differential pressure, and an auxiliary valve object.

[0013] The solenoid valve of this invention equipped with this configuration is arranged in the duct between the brake fluid pressure generating means, such as a master cylinder, and the wheel damping force generating means, such as a wheel cylinder which generates wheel damping force by brake fluid pressure, of generating brake fluid pressure at the time of car braking, and is equipped with the main valve and the auxiliary valve, for example.

[0014] Although the main valve object which a main valve has moves in the predetermined direction (for example, shaft orientations) and the main free passage way which is a duct is opened and closed, this main valve object will be in the condition that the duct is slightly open for free passage on a drawing free passage way, even if it is the case where the main free passage way is closed with a main valve object, since it has the drawing free passage way which extracts the passage of a duct.

[0015] Since the auxiliary valve object which an auxiliary valve has moves in the same direction as a main valve object on the other hand and the drawing free passage way of a main valve object is opened and closed, when closing and an auxiliary valve object extract the main free passage way and a main valve object closes a free passage way, a duct is blockaded thoroughly. This is called close-by-pass-bulb-completely condition. Furthermore, a valve element energization member can energize a main valve object and an auxiliary valve object, and is movable in between an open position and closed positions. This open position is a location corresponding to the full admission condition of energizing a main valve and opening the main free passage way while it energizes and extracts an auxiliary valve object and opens a free passage way, and a closed position is a location corresponding to the close-by-pass-bulb-completely condition which energizes neither a main valve object nor an auxiliary valve object. And this valve element energization member is energized by the elastic operation to the predetermined direction which is the migration direction of a main valve of the 1st elastic member so that it may go to an open position from a closed position.

[0016] Moreover, an electromagnetic-force grant means gives the electromagnetic force which the energization force by the 1st elastic member is overcome [electromagnetic force], and makes a closed position maintain a valve element energization member. Moreover, when a valve element energization member is in a closed position, the 2nd elastic member energizes a main valve object through an auxiliary valve object, and closes the main free passage way while it energizes and extracts an auxiliary valve object according to the elastic operation to the predetermined direction which is the migration direction of a main valve and closes a free passage way.

[0017] And in the solenoid valve of this invention, it is set up so that the energization force (differential pressure energization force) over the energization force by the 1st elastic member and the 2nd elastic member, the electromagnetic force given by the electromagnetic-force grant means, the main valve object by differential pressure, and an auxiliary valve object may fulfill the following conditions. that is, in the condition that electromagnetic force is not given by the electromagnetic-force grant means Although a main valve object is energized by differential pressure and the main free passage way is closed when differential pressure with low brake fluid pressure is acting on a main valve object and an auxiliary valve object relatively [a brake fluid pressure generating means side] relatively [a high brake fluid pressure and wheel damping force generating means side] An auxiliary valve object will be in the half-opening condition of it being energized by the valve element energization member, extracting, and opening a free passage way, and when differential pressure is not acting, it is set up so that it may be in said full admission condition.

[0018] Consequently, if an electromagnetic-force grant means does not give electromagnetic force when there is no differential pressure of the brake fluid pressure by the side of a brake fluid pressure generating means and the brake fluid pressure by the side of a wheel damping force generating means, while a valve element energization member energizes and extracts an auxiliary valve object and opens a free passage way, it will be in the full admission condition of energizing a main valve object and opening the main free passage way. Therefore, in the state of this full admission, the wheel damping force according to the brake fluid pressure generated with the brake fluid pressure generating means can realize so-called "it being usually a brake condition". [which is generated with a wheel damping force generating means]
[0019] On the other hand, when performing brake control of for example, ABS control, TRC control, etc., control in the ****** mode which stopped the hold mode holding the brake fluid pressure in a wheel damping force generating means and the boost rate, the dither boost mode in which a comparatively sudden boost is performed, reduced pressure mode, etc. will be performed. Although it is necessary to realize the close-by-pass-bulb-completely condition and half-opening condition which were mentioned above in order to suppress pressure pulsation with the momentary boost in this ****** mode (pulse boost), in the solenoid valve of this invention, the close-by-pass-bulb-completely condition and the half-opening condition are realized as follows.
[0020] When realizing a close-by-pass-bulb-completely condition and electromagnetic force is given by the electromagnetic-force grant means, the valve element energization member energized so that it might go to an open position from a closed position by the energization force by the 1st elastic member will move to a closed position, and will be maintained in the location. In order that the valve element energization member in a closed position may energize neither a main valve object nor an auxiliary valve object, it energizes a main valve object through an auxiliary valve object, and closes the main free passage way while the 2nd elastic member energizes and extracts an auxiliary valve object and closes a free passage way. Therefore, it will be in the close-by-pass-bulb-completely condition that the duct was blockaded thoroughly.
[0021] Moreover, if grant of the electromagnetic force by the electromagnetic-force grant means is stopped in this close-by-pass-bulb-completely condition, it will shift to a half-opening condition. That is, although the above-mentioned close-by-pass-bulb-completely condition corresponds to the hold mode of brake control, in this hold mode, high brake fluid pressure will have occurred relatively at a brake fluid pressure generating means side. Although it was got blocked, for example, the operator stepped on the brake pedal and high brake fluid pressure has occurred relatively with the brake fluid pressure generating means, it holds relatively by brake control in the wheel damping force generating means side at low brake fluid pressure. Therefore, if grant of the electromagnetic force by the electromagnetic-force grant means is stopped in the close-by-pass-bulb-completely condition which differential pressure has generated in this way, the main valve object energized by differential pressure will close the main free passage way. However, the auxiliary valve object energized by differential pressure is energized by the valve element energization member to hard flow, and opens a drawing free passage way. Therefore, the half-opening condition which extracted although closed, and opened the free passage way is acquired, and the main free passage way can realize brake control by little boost actuation of the pressure pulsation in ****** mode. Then, if the brake pedal stepped on is returned and differential pressure is lost, a main valve object is also energized by the valve element energization member, and the main free passage way will be in an aperture and a full admission condition.
[0022] Thus, according to the solenoid valve of this invention, though it is possible to realize the half-opening condition which extracted besides the full admission condition and the close-by-pass-bulb-completely condition, and opened only the free passage way, the half-opening condition is realized using the differential pressure produced by brake control in a close-by-pass-bulb-completely condition, and grant of the electromagnetic force by the electromagnetic-force grant means is unnecessary. Therefore, it is good at easy control of whether with the solenoid valve of this invention, the electromagnetic force of immobilization is given by distinguishing the electromagnetic force for half-opening conditions, and the electromagnetic force for close-by-pass-bulb-completely conditions, and not giving them like before, or not to carry out.
[0023] Moreover, in the condition that grant of the electromagnetic force by the electromagnetic-force grant means is not carried out, since a full admission condition and a half-opening condition change by the existence of differential pressure, the valve element structure itself will also make the function of a check valve serve a double purpose. That is, since it is not necessary to prepare a check valve separately, when it applies to a brake gear, it contributes also to simplification of the configuration of the whole brake gear.

[0024] In addition, as for the differential pressure energization force of acting on the auxiliary valve object which sets up the differential pressure energization force of acting on the main valve object which closes the main free passage way in a half-opening condition, in consideration of the minimum value of differential pressure, extracts in a half-opening condition on the other hand, and opens a free passage way, it is desirable to set up in consideration of the maximum of differential pressure. This reason is explained. The differential pressure used as the radical of the differential pressure energization force is not necessarily fixed, for example, if the case where it applies to a brake gear is assumed, it will be a value with a certain range which changes according to the treading-in condition of a brake pedal etc. Therefore, in considering the differential pressure energization force in the case of energizing the main valve object energized in the direction which opens the main free passage way by the valve element energization member when differential pressure does not arise in the direction which closes the main free passage way, since the actuation is realized even if it is the minimum value of the differential pressure to produce, it takes the minimum value of differential pressure into consideration. It is because the main free passage way can be closed satisfactory when bigger differential pressure than the minimum value arises if it does in this way. When differential pressure does not arise, even if differential pressure produces the auxiliary valve object energized in the direction which extracts by the valve element energization member and opens a free passage way, in, considering the differential pressure energization force for making it possible to change into the condition of having opened the drawing free passage way too on the other hand, since the actuation is realized even if it is the maximum of the differential pressure to produce, it takes the maximum of differential pressure into consideration. It is because it can change into the condition of having opened the drawing free passage way satisfactory when differential pressure smaller than the maximum arises if it does in this way.

[0025] And since this differential pressure energization force specifically becomes what multiplied the projected net area of a main valve object and an auxiliary valve object by differential pressure, the projected net area of a main valve object and an auxiliary valve object is set up so that it may become the differential pressure energization force set [object / the minimum value of differential pressure, and / auxiliary valve] up in consideration of the maximum of differential pressure about the main valve object, respectively.

[0026] Moreover, the shaft section inserted in the main free passage way about said valve element energization member, In the half-opening location in the middle of having been prepared at the head of the shaft section, having the cylindrical height inserted in in the drawing free passage way of a main valve object, and moving to an open position from a closed position Although an auxiliary valve object is energized and extracted in a cylindrical height and a free passage way is opened, if a main valve object is not energized but it moves to an open position further, it is possible to constitute so that a main valve object may be energized in the shaft section and the main free passage way may be opened.

[0027] On the other hand, a main valve object may be constituted in tubed, and the 2nd elastic member which energizes an auxiliary valve object and its auxiliary valve object may be constituted so that it may arrange to the tubed main valve inside of the body. Furthermore, although it is possible to constitute so that a valve element energization member may be maintained by the closed position by preparing said valve element energization member in the plunger of the magnetic substance in one, giving electromagnetic force, attracting a plunger and contacting a stopper with an electromagnetic-force grant means, it is possible to infix the member of non-magnetic material in the field where a plunger contacts a stopper in that case.

[0028] Moreover, although the member of the non-magnetic material in this case may be prepared all over the field where a plunger counters a stopper, it is also desirable to prepare in a part of that opposed face, and to prepare so that a plunger may become closer to a stopper than other parts of the fields which counter a stopper. If this is prepared all over the field where the member of non-magnetic material counters a stopper, it will become an inhibition factor in case both whom the surface tension by the so-called oil film etc. contacted when, as for close, both contacted [brake fluid] estrange between the member of non-magnetic material, and a stopper, and it leads to lowering of the response of control. Therefore, by preparing the member of non-magnetic material in said a part of opposed face, an inhibition factor in case both who contacted estrange is reduced, and it leads to improvement in the response of control.

[0029] In addition, the solenoid valve mentioned above is although it can use for various pressure circuits. For example, it is possible to adopt as a fluid pressure control valve used in case wheel-cylinder ** in the brake operating unit which gives wheel damping force by whether it ****s with the brake fluid which supplies wheel-

cylinder ** from pressure sources, such as a master cylinder, this wheel-cylinder ** is decompressed, or this wheel-cylinder ** is held is ****ed. And it will have the control means which controls activation and un-performing in this case. [of grant of the electromagnetic force by the electromagnetic-force grant means] It is used for the antiskid control (ABS) which shortens a brake stopping distance, the traction control (TRC) at the time of an acceleration slip, etc. with this brake operating unit, preventing the wheel lock at the time of braking on the road surface on which it is easy to slide for example, and securing braking stability.

[0030]

[Embodiment of the Invention] Hereafter, the suitable example of this invention is explained based on a drawing. In addition, as long as the gestalt of operation of this invention is not limited to the following example at all and belongs to the technical range of this invention, it cannot be overemphasized that various gestalten can be taken.

[1st example] drawing 1 - drawing 3 are sectional views to show the outline configuration and its actuation of the solenoid valve which is the 1st example of this invention, and drawing 4 is model drawing showing the outline configuration at the time of applying a solenoid valve to the antiskid-control equipment as a brake operating unit. In addition, by drawing 4 , in order to simplify explanation, only the brake pipe line over one flower is shown.

[0031] As shown in drawing 4 , a sensor 5 is arranged whenever [wheel speed /, such as electromagnetic or a magnetic-reluctance type,], and the pulse signal of a frequency according to the revolution of a wheel 1 is outputted to a wheel 1. Furthermore, an oil hydraulic brake equipment (henceforth a wheel cylinder) 11 is arranged at a wheel 1, and a wheel 1 is made to generate damping force. The oil pressure from the master cylinder 16 generated by treading in of a brake pedal 15 is sent through the boost control valve 21 and hydraulic line for mainly performing boost control.

[0032] Here, when the antiskid control is not performed, the boost control valve 21 is made into the free passage condition, and the oil pressure from a master cylinder 16 lets the boost control valve 21 pass, and is transmitted to a wheel cylinder 11. Therefore, in this case, the oil pressure from a master cylinder 16 is transmitted to a wheel cylinder 11 according to treading in of crew's brake pedal 15, and damping force occurs for a wheel 1.

[0033] Next, from the hydraulic line which connects a wheel cylinder 11 and the boost control valve 21, the hydraulic line for missing the brake fluid in a wheel cylinder 11 to a reservoir 25 is prolonged, and the reduced pressure control valve 23 for opening for free passage and intercepting this duct is arranged at this hydraulic line. And the reservoir 25 is connected to the hydraulic line which connects a master cylinder 16 and the boost control valve 21 through the hydraulic pump 30. In addition, the damper orifice 6 is formed between the hydraulic line which the damper 4 which suppresses pulsation of internal oil pressure is formed in the regurgitation path of the brake fluid from a hydraulic pump 30, and connects the master cylinder 16 mentioned above and the boost control valve 21, and this damper 4.

[0034] Moreover, between the hydraulic line which connects a wheel cylinder 11 and the boost control valve 21, and the master cylinder 16, the check valve 22 which permits only floating of the brake fluid from a wheel-cylinder 11 side to a master cylinder 16 side is arranged. The boost control valve 21 and the reduced pressure control valve 23 which were mentioned above are a solenoid valve, and when power is supplied based on the signal from an electronic control 10 (it is called Following ECU), the valve element changes, when a solenoid excites, and switches a free passage and cut off state of a port. In addition, in the condition of not being started at the time of un-operating [of each valve], i.e., an antiskid control, a port is located in a graphic display location.

[0035] Although the reduced pressure control valve 23 mentioned above is 2 port two position valve used also from the former, as for the boost control valve 21, the solenoid valve of this example is adopted, and it enables it to also realize a drawing free passage condition from the former in addition to two conditions of a certain free passage and maintenance. This boost control valve 21 serves as A location shown in drawing 4 at the time of un-energizing, will be in a free passage condition, is changed to C location shown in drawing 4 at the time of energization, and will be in a maintenance condition. When it changes into the condition that energization is not carried out again, after the maintenance condition, it will be in the drawing free passage condition shown in B location by the differential pressure of the fluid pressure by the side of a master cylinder, and the fluid pressure by the side of a wheel cylinder. In addition, suppose that it mentions later with reference to drawing 1 - drawing

3 about the detailed structure of this boost control valve 21, and the actuation to each location of Above A, B, and C.

[0036] On the other hand, centering on the microcomputer which consists of CPU, ROM, RAM, an input/output interface, etc., since, ECU10 is constituted. Moreover, while a power source is supplied, and ECU10 receives the signal from a sensor 5, the stop switch (graphic display abbreviation) switch on at the time of treading in of a brake pedal 15 whenever [said wheel speed] and carries out operation presumption of the slip condition of a wheel 1 by turning on the ignition switch which is not illustrated, it performs operation control for brake-force control, and outputs the actuation control signal over the boost control valve 21 and the reduced pressure control valve 23.

[0037] Then, with reference to drawing 1 - drawing 3 , the configuration of the boost control valve 21 is explained in detail. In addition, drawing 1 shows the case where drawing 3 has a valve element in the "half-opening location" corresponding to B location in drawing 4 , respectively, when a valve element is in the "open position" corresponding to A location in drawing 4 , and drawing 2 has a valve element in the "closed position" corresponding to C location in drawing 4 .

[0038] As shown in drawing 1 , although the boost control valve 21 which is a solenoid valve arranged in the duct between a master cylinder 16 and a wheel cylinder 11 is always made open, it is the so-called normally open (Normal Open) valve which serves as close at the time of energization, and closes the duct. This boost control valve 21 is equipped with the valve system constituted over housing and the solenoid 40 which are not illustrated while it is equipped with a solenoid 40.

[0039] Said solenoid 40 is equipped with the stopper 41 which blockades the upper bed of the centrum, and drives respectively ON of energization, and the valve system mentioned more later off to open and a closed state while it is equipped with a cylinder-like centrum in the center. The tubed sheet bulb 70 which a valve system is equipped with the 1st opening 75 which is open for free passage to a master cylinder 16 side, and is fixed to housing which is not illustrated (main valve seat), An own soffit is attached outside and fixed to the upper part of the sheet bulb 70. An own upper bed inner to the centrum of a solenoid 40 The sleeve 60 of the non-magnetic material **(ed) and fixed, It is arranged in a sleeve 60 and consists of a plunger 50 as a valve element migration member movable in the vertical direction, a tubed main valve object 80 arranged in the sheet bulb 70, an auxiliary valve object 90 arranged in the main valve object 80.

[0040] The main free passage way 71 is established in the shaft orientations at said tubed sheet bulb 70, and the main valve object 80 opens and closes the main free passage way 71. The side opening 83 is formed in the side at this main valve object 80, and when the main free passage way 71 is open, the brake fluid which flowed out between the main valve object 80 and the sheet bulb 70 through the side [this] opening 83 is constituted possible [runoff] through the main free passage way 71. In addition, with the part in which said main free passage way 71 was established, the plinth 85 is being fixed to the opposite hand by the sheet bulb 70, and the omission omission from the sheet bulb 70 of the main valve object 80 is prevented by this plinth 85.

[0041] It extracts to the shaft orientations, the free passage way 81 is established in the main valve object 80, and the auxiliary valve object 90 opens and closes the drawing free passage way 81. The auxiliary valve object 90 is a spherical valve element, and is energized in the direction which closes the drawing free passage way 81 of the main valve object 80 with an auxiliary spring 99. In detail, the auxiliary valve object 90 is energized in the direction which closes the drawing free passage way 81 of the main valve object 80 with an auxiliary spring 99 by the end of an auxiliary spring 99 contacting said plinth 85 fixed to the sheet bulb 70, and the other end being in contact with the auxiliary valve object 90, and being infixed in the condition of having been compressed among these. In addition, this drawing free passage way 81 is made quite narrower than the main free passage way 71. And from extracting to the shaft orientations of the main valve object 80, and the free passage way 81 being formed, thoroughly, even if it is not blockaded depending on the main valve object 80 but the main valve object 80 sits down to the sheet bulb 70, the main free passage way 71 is extracted if the auxiliary valve object 90 has not sat down, and is opening the part of the free passage way 81. Therefore, suppose that the condition of extracting although the "close-by-pass-bulb-completely condition" and the main free passage way 71 have closed the condition that both "the full admission condition", the main free passage way 71, and the drawing free passage way 81 have closed the condition that the main free passage way 71 is open at least, and opening the free passage way 81 is called a "half-opening condition" in the following explanation.

[0042] Moreover, the main free passage way 71 of said sheet bulb 70 and the 2nd opening 65 open for free passage are formed in the side face of the lower part (from the sheet bulb 70, it is the upper part in detail) of a sleeve 60. This 2nd opening 65 will be open for free passage the wheel-cylinder 11 side, and the brake fluid which has flowed by this through the main free passage way 71 or the drawing free passage way 81 from the 1st opening 75 which it was supplied from the master cylinder 16 side, and was mentioned above will flow out of the 2nd opening 65 into a wheel-cylinder 11 side.
[0043] Although it mentioned that the plunger 50 was arranged above in the sleeve 60 The crevice is formed in the center of the edge which counters the back end 41 of this plunger 50, i.e., a stopper. Into it, where a return spring 59 is compressed, it is inserted, and when the end of a return spring 59 contacts a stopper 41 further, the plunger 50 is energized in the direction (it sets to drawing 1 and is a lower part) estranged from a stopper 41. In addition, it is set up so that it may become the energization force (FSP2) of the energization force (FSP1) > auxiliary spring 99 of a return spring 59.
[0044] Moreover, immobilization or the side free passage way 57 which is arranged free movable and opens the head and the back end of a plunger 50 for free passage in the side face of a plunger 50 is established for the plate 58 of non-magnetic material in the field where a plunger 50 counters a stopper 41. On the other hand, the shaft section 51 which can be inserted in the main free passage way 71 established in the sheet bulb 70 is formed in one, and the cylindrical projection 53 which can be inserted in the drawing free passage way 81 established in the main valve object 80 is further formed at the head of that shaft section 51 too in one at the main valve object, head 70, i.e., sheet bulb, of this plunger 50, 80 side.
[0045] The head of the cylindrical projection 53 which extracted in the condition of it being formed for a long time than the drawing free passage way 81, and the auxiliary valve object 90 having extracted, and having closed the free passage way 81, and was inserted in the free passage way 81 contacts the auxiliary valve object 90, and this cylindrical projection 53 is pushed further caudad, is extracted, and enables it to make even the condition of opening the free passage way 81 moved. The shaft section 51 is formed for a long time than the main free passage way 71, and the shaft section 51 by which the main valve object 80 was inserted in the main free passage way 71 in the condition of having closed the main free passage way 71 contacts the main valve object 80, and it enables it similarly even for the condition of pushing further caudad and opening the main free passage way 71 to be moved by it.
[0046] In addition, the cylindrical projection 53 is formed more thinly than the drawing free passage way 81, and even if it is in the condition which the cylindrical projection 53 extracts and is inserted in in the free passage way 81, brake fluid enables it to flow the clearance between both. The shaft section 51 is formed more thinly than the main free passage way 71, and even if it is in the condition that the shaft section 51 is inserted in in the main free passage way 71, brake fluid enables it similarly to flow the clearance between both. Moreover, although the part by which the cylindrical projections 53 are formed successively from the shaft section 51 is inserted in the main free passage way 71, the notch 55 is formed in this successive formation part, and it is made to have the flow of the drawing free passage way 81 in the condition that the shaft section 51 contacted the main valve object 80 secured.
[0047] Next, about actuation of the boost control valve 21 which has the structure mentioned above, the time of using this boost control valve 21 for the boost control valve of the hydraulic circuit for ABS is mentioned as an example, and is explained.
(1) Explain the actuation at the time of the Normal brake first. At the time of the Normal brake, the boost control valve 21 is in A location in hydraulic-circuit drawing, i.e., the free passage location, (condition of not energizing) of drawing 4 , and the reduced pressure control valve 23 is in a cutoff location (condition of not energizing). As a suction force does not occur since the boost control valve 21 at this time does not have the energization to a solenoid 40, but shown in drawing 1 A plunger 50 is energized below (direction approaching the main valve object 80) with a return spring 59. The head of the cylindrical projection 53 inserted in the drawing free passage way 81 contacts the auxiliary valve object 90. Since it is set up so that it may become the energization force (FSP2) of the energization force (FSP1) > auxiliary spring 99 of a return spring 59, it is made to move even to the condition of pushing the auxiliary valve object 90 further caudad, extracting it, and opening the free passage way 81. Moreover, the shaft section 51 inserted in the main free passage way 71 also contacts the main valve object 80, and makes it move even to the condition of pushing further caudad and opening the main free passage way 71.

[0048] For this reason, it will be in the full admission condition which both the main free passage way 71 and the drawing free passage way 81 opened as [show / in drawing 1]. Although the brake fluid pressure according to the amount of treading in of a brake pedal 15 occurs in a master cylinder 16, in the state of this full admission, the wheel damping force according to the brake fluid pressure generated in the master cylinder 16 can realize the "Normal brake condition" of generating in a wheel cylinder 11.
Since there is a possibility that it may become impossible to control a car when a slip of each wheel generates ABS control by the rapid brakes operation of a driver, when an operator is going to perform brakes operation and generally brake the car in (2) and time that such a phenomenon should be prevented, it is carried out in order to make the slip condition of each wheel proper.
[0049] If it judges that ECU10 has a wheel in a lock inclination if ABS control is explained based on drawing 4 , while making the boost control valve 21 into C location (energization condition), i.e., a cutoff location, the reduced pressure control valve 2 is made into a free passage location (energization condition), wheel-cylinder ** is decompressed, and the lock of a wheel is prevented. The oil quantity decompressed from the wheel cylinder 11 at this time is discharged by the reservoir 25 through the reduced pressure control valve 23, and returns to a master cylinder 16 side with a pump 30.
[0050] Then, although wheel-cylinder ** is made to **** if ECU10 judges that the lock inclination of a wheel was solved Since a wheel will serve as a lock inclination if wheel-cylinder ** is made to increase rapidly, The condition of making both the boost control valve 21 and the reduced pressure control valve 23 intercepting, and holding wheel-cylinder **, By control which repeats slowly-increasing ****** which makes pulsation etc. **** few gently [carry out to B location which shows only the boost control valve 21 to drawing 4 , i.e., a half-opening location, and / ** / wheel-cylinder], and is realized Wheel-cylinder ** is made to increase gradually, and the stability of a car is secured, preventing the lock of a wheel.
(2a) First explain actuation by the boost control valve 21 in the case of changing wheel-cylinder ** into a maintenance condition.
[0051] In order that a suction force with which a plunger 50 approaches a stopper 41 may work in order to energize to a solenoid 40, and this suction force may overcome the difference of the energization force of a return spring 59 and an auxiliary spring 99, the boost control valve 21 at this time is maintained by the condition that the back end of a plunger 50 contacted the stopper 41 through the plate 58 as shown in drawing 2 .
[0052] In this condition, the head of the cylindrical projection 53 inserted in the drawing free passage way 81 does not contact the auxiliary valve object 90, and the shaft section 51 inserted in the main free passage way 71 is not in contact with the main valve object 80 further, either. Therefore, while the auxiliary valve object 90 energized with the auxiliary spring 99 sits down and extracts to the valve seat part of the main valve object 80 and closes the free passage way 81, in order to also energize main valve object 80 the very thing further and to sit the sheet bulb 70, the main free passage way 71 is also closed. Therefore, the "perfect" clausilium condition that both the passage of the main free passage way 71 and the drawing free passage way 81 was shut is realized.

[0053] Therefore, even if the brake fluid pressure according to the amount of treading in of a brake pedal 15 has occurred in the master cylinder 16, the brake fluid pressure generated in the master cylinder 16 in this "perfect" clausilium condition does not act on wheel-cylinder **, and can realize the "maintenance condition" of wheel-cylinder **. And in this case, since master-cylinder-pressure Pm is usually higher than wheel-cylinder ** Pw, the force of a direction of sitting the main valve object 80 and the auxiliary valve object 90, respectively will act by differential pressure **P (= Pm-Pw) which is both pressure differential.
[0054] in addition, the force of this direction to sit -- the main valve object 80 and the auxiliary valve object 90 -- it is what multiplied each projected net area A by differential pressure **P (A-**P). The projected net area A1 of the main valve object 80 and the projected net area A2 of the auxiliary valve object 90 can be found by the following type, respectively.
A1= (piD12)/4 (however, D1; diameter of the sheet part of the main valve object 80)
A2= (piD22)/4 (however, D2; diameter of the sheet part of the auxiliary valve object 90)
(2b) Next, explain actuation by the boost control valve 21 in the case of making wheel-cylinder ** into slowly-increasing ****** which ****s gently. This slowly-increasing ****** is realized by stopping the energization to a solenoid 40 in the maintenance condition mentioned above. If the energization to a solenoid 40 is stopped,

the suction force which was being committed so that a plunger 50 might approach a stopper 41 will be lost, and a return spring 59 will energize in the direction which estranges a plunger 50 from a stopper 41. If it is only the relation between a return spring 59 and an auxiliary spring 99, in order that the energization force of a return spring 59 may overcome the energization force of an auxiliary spring 99, it will be in the full admission condition which both the main free passage way 71 and the drawing free passage way 81 opened as [show / in drawing 1] like the Normal brake condition mentioned above.

[0055] However, the condition in front of this slowly-increasing ****** is in a maintenance condition. In the state of maintenance, as mentioned above, the force of a direction of sitting the main valve object 80 and the auxiliary valve object 90, respectively is acting by differential pressure **P (=Pm-Pw) of master-cylinder-pressure Pm and wheel-cylinder ** Pw in addition to the spring force by the spring, or electromagnetic force. Therefore, even if electromagnetic force is lost, in addition to the energization force of a return spring 59 and an auxiliary spring 99, the energization force (force of a direction of sitting the main valve object 80 and the auxiliary valve object 90, respectively) by differential pressure **P is acting on the main valve object 80 and the auxiliary valve object 90.

[0056] And in this example, although it can change into the condition of making it estranging from the valve seat part of the main valve object 80 to the auxiliary valve object 90, extracting, and opening the free passage way 81, as [show / in drawing 3], to the main valve object 80, the condition of having sat down on the sheet bulb 70 will be maintained. It is because the force (A1and**P) of a direction in which that the main valve object 80 is maintained by the taking-a-seat condition sits the main valve object 80 produced in differential pressure **P is relatively large, so energization **** (FSP1-FSP2) of a return spring 59 and an auxiliary spring 99 is overcome. The force (A2and**P) of a direction in which that the auxiliary valve object 90 opens, on the other hand, sits the auxiliary valve object 90 produced in differential pressure **P is relatively small, and is because it is smaller than energization **** (FSP1-FSP2) of a return spring 59 and an auxiliary spring 99.

[0057] For this reason, although the main free passage way 71 is closed, the drawing free passage way 81 can be made into the open half-opening condition, and this slowly-increasing ****** that makes wheel-cylinder ** **** gently in the state of half-opening can be realized.

(3) In the half-opening condition shown in this drawing 3 , if it energizes to a solenoid 40 again, it will be in the close-by-pass-bulb-completely condition shown in drawing 2 .

[0058] Moreover, since differential pressure **P has produced the half-opening condition shown in drawing 3 , it will be in such a condition, but when ABS control is completed, since the oil quantity decompressed from the wheel cylinder 11 by changing the reduced pressure control valve 23 into a free passage condition is discharged by the reservoir 25 through the reduced pressure control valve 23 and it returns to a master cylinder 16 side with a pump 30, differential pressure **P is set to 0 in the culmination of boost control. In that case, it will be in the full admission condition shown in drawing 1 .

[0059] thus, in the boost control valve 21 which is a solenoid valve of this example Besides the close-by-pass-bulb-completely condition that both the full admission condition and both free passage ways 71 and 81 that both the main free passage way 71 and the drawing free passage way 81 are opening for free passage are intercepted While the effective half-opening condition 71, i.e., the main free passage way, can realize the condition that extract although intercepted, and the free passage way 81 is open for free passage, in respect of pulsating prevention etc. Although the half-opening condition is realized using differential pressure **P produced in a close-by-pass-bulb-completely condition and this half-opening condition is realized, the energization to a solenoid 40 is unnecessary. Therefore, it is good at easy control of whether it only energizes to a solenoid 40 by distinguishing the electromagnetic force for half-opening conditions, and the electromagnetic force for close-by-pass-bulb-completely conditions (that is, current value supplied to a solenoid 40), and not giving them like before, or not to carry out.

[0060] Moreover, in the condition that energization to a solenoid 40 is not carried out, since a full admission condition and a half-opening condition change by the existence of differential pressure **P, the valve element structure itself will also make the function of the check valve 22 in hydraulic-circuit drawing of drawing 4 serve a double purpose. That is, since it is not necessary to form a check valve 22 separately, the configuration as the whole brake operating unit is also simplified.

[0061] Next, conditions for the boost control valve 21 to perform actuation mentioned above are explained. The conditions for here maintaining the full admission condition, close-by-pass-bulb-completely condition, and half-

opening condition which were mentioned above, As conditions for shifting to another condition from a certain condition, the energization force of a return spring 59 (FSP1), The energization force (FSP2) of an auxiliary spring 99, the electromagnetic force produced by turning on a solenoid 40 (energization) (Fcoil), The relation between the differential pressure energization force (A1and**P) which is force over the main valve object 80 by differential pressure **P, and the differential pressure energization force (A2and**P) over the auxiliary valve object 90 by differential pressure **P is explained.

[0062] ** The force which should be taken into consideration in the case of the maintenance full admission condition (drawing 1) of a full admission condition is the energization force (FSP1) of a return spring 59, and energization force (FSP2) of an auxiliary spring 99, and the conditions searched for among these are as follows.

[0063] Since the shift electromagnetic force (Fcoil) from a FSP1 >FSP2 >0** full admission condition (drawing 1) to a close-by-pass-bulb-completely condition (drawing 2) acts and it shifts to a close-by-pass-bulb-completely condition from a full admission condition, the force which should be taken into consideration is the energization force (FSP1) of a return spring 59, the energization force (FSP2) of an auxiliary spring 99, and electromagnetic force (Fcoil), and the conditions searched for among these are as follows.

[0064] When the maintenance close-by-pass-bulb-completely condition (drawing 2) of a Fcoil>FSP1-FSP2** close-by-pass-bulb-completely condition continues the energization force (FSP1) of a return spring 59, the energization force (FSP2) of an auxiliary spring 99, and electromagnetic force (Fcoil) -- in addition, although the differential pressure energization force (A1and**P) by differential pressure **P and (A2and**P) act Since this is the force to the direction which maintains a close-by-pass-bulb-completely condition, it is not necessary to take it into consideration, and it is the same as the conditions in the shift to the close-by-pass-bulb-completely condition (drawing 2) of the above-mentioned ** from a full admission condition (drawing 1) after all. That is, the conditions searched for are as follows.

[0065] If electromagnetic force (Fcoil) is set to 0 in the state of the shift close by-pass bulb completely from a Fcoil>FSP1-FSP2** close-by-pass-bulb-completely condition (drawing 2) to a half-opening condition (drawing 2), it will shift to a half-opening condition. Therefore, the force which should be taken into consideration is the differential pressure energization force (A1and**P) by the energization force (FSP1) of a return spring 59, the energization force (FSP2) of an auxiliary spring 99, and differential pressure **P, and (A2and**P). And since the main valve object 80 needs to maintain the condition of having sat down as well as the close-by-pass-bulb-completely condition, the conditions searched for about the main valve object 80 are as follows.

[0066] Although A1 and **P>FSP1-FSP2 one side and the auxiliary valve object 90 had sat down in the state of the close by-pass bulb completely, since it is necessary to open them in the state of this half-opening, the conditions searched for about the auxiliary valve object 90 are as follows.

The conditions in the case of maintaining the maintenance half-opening condition (drawing 3) of FSP1-FSP2 >A2 and a **P** half-opening condition are the same as the shift to the half-opening condition of the above-mentioned ** from a close-by-pass-bulb-completely condition.

[0067] ** The shift of ****** to a close-by-pass-bulb-completely condition (drawing 2) from a half-opening condition (drawing 3) is performed by electromagnetic force (Fcoil) acting. As a result, it is the same as the shift to the close-by-pass-bulb-completely condition of ** mentioned above from a full admission condition.

** The shift of ****** to a full admission condition (drawing 1) from a half-opening condition (drawing 3) is performed when differential pressure **P is set to 0. Since the force which should be taken into consideration in addition to differential pressure **P is the energization force (FSP1) of a return spring 59, and energization force (FSP2) of an auxiliary spring 99, it is the conditions same as a result as the case of maintenance of the full admission condition of ** mentioned above.

[0068] It is as follows when the conditions of ** - ** mentioned above are summarized.

It is necessary to take the following point into consideration further about Fcoil>FSP1-FSP2>0A1 and **P>FSP1-FSP2FSP1-FSP2 >A2 and **P among these the differential pressure energization force (A1and**P) that is force over the main valve object 80, and the differential pressure energization force (A2and**P) over the auxiliary valve object 90. That is, the differential pressure energization force (A1and**P) which is force over the main valve object 80 is set up in consideration of the minimum value of differential pressure **P, and, as for the differential pressure energization force (A2and**P) of on the other hand acting on the auxiliary valve object 90, it is desirable to set up in consideration of the maximum of differential pressure **P. This reason is

explained.
[0069] Differential pressure **P used as the differential pressure energization force (A1and**P) and the radical of (A2and**P) is a value with a certain range (from several 10 atmospheric pressures to for example, several 100 atmospheric-pressure extent) which changes according to the treading-in condition of a brake pedal 15 etc. rather than is [for example,] necessarily fixed. Therefore, since the actuation is realized even if it is the minimum value of differential pressure **P to produce to consider the differential pressure energization force (A1and**P) in the case of overcoming energization **** (FSP1-FSP2) of a return spring 59 and an auxiliary spring 99, and sitting the main valve object 80 in order to realize a half-opening condition (drawing 3), it is considered that the minimum value of differential pressure **P mentioned above. It is because the main free passage way 71 can be closed satisfactory when bigger differential pressure **P than the minimum value arises if it does in this way. Since the actuation is too realized on the other hand even if it is the maximum of differential pressure **P to produce to consider the differential pressure energization force (A2and**P) for keeping [in / the condition which the drawing free passage way 81 opened too] been to the auxiliary valve object 90, even if differential pressure **P arises, the maximum of differential pressure **P is taken into consideration. It is because it can change into the condition of having opened the drawing free passage way 81 satisfactory when differential pressure **P smaller than the maximum arises if it does in this way.
[0070] Therefore, about minimum value **Pmin of differential pressure **P, and the auxiliary valve object 90, it is [object / 80 / main valve] maximum **Pmax of differential pressure **P. It is as follows when three conditions mentioned above are arranged using the differential pressure energization force (A1 and **Pmin) and (A2 and **Pmax) which were taken into consideration and set up, respectively. [ ]
[0071] Fcoil>FSP1-FSP2>0A1 and **Pmin >FSP1-FSP2FSP1-FSP2 >A2 and **Pmax -- in addition This differential pressure energization force (A1 and **Pmin) and (A2 and **Pmax) Since it becomes what specifically multiplied the projected net area of the main valve object 80 and the auxiliary valve object 90 by differential pressure **P, the projected net areas A1 and A2 of the main ****** 80 ****** valve element 90 are set up so that it may be set to these differential pressure energization force (A1 and **Pmin) and (A2 and **Pmax). In addition, in this example, as mentioned above, since it is dependent on the diameter D1 of the sheet part of the main valve object 80, and the diameter D2 of the sheet part of the auxiliary valve object 90, respectively, projected net areas A1 and A2 should just set up these diameters D1 and D2 suitably.
[2nd example] drawing 5 is the sectional view showing the outline configuration of the solenoid valve which is the 2nd example of this invention.
[0072] Although the fundamental configuration is the same as the 1st example shown by drawing 1 etc., the following two places differ. Blindness in one eye is the point of trying for the part which counters the soffit 85 of the tubed main valve object 80, i.e., a plinth, not to be contacted by the plinth 85 in a full admission condition (drawing 5), first. Although the shaft section 51 which can be inserted in the main free passage way 71 was formed at the head of a plunger 50 in one in the 1st example of the above, it extracted at the head of the shaft section 51 and the cylindrical projection 53 which can be inserted in the free passage way 81 was further formed in one, the second The major diameters 56 which have a bigger cross section than the main free passage way 71 at the head of a plunger 50 in the case of this 2nd example are formed successively, and the shaft section 51 and the cylindrical projections 53 are formed in order successively by that major diameter 56.
[0073] Therefore, even if a plunger 50 is energized with a return spring 59 in the direction estranged from a stopper 41, the major diameter 56 mentioned above contacts the sheet bulb 70, and migration beyond it of a plunger 50 is regulated. Although the cylindrical projection 53 is energizing the auxiliary valve object 90 too in this condition, the shaft section 51 is not necessarily in contact with the main valve object 80. That is, the main valve object 80 will be maintained in the condition that between the location which contacts the shaft section 51, and the locations where the auxiliary valve object 90 sits down is freely movable. In addition, in the location where the main valve object 80 contacts the shaft section 51, the main free passage way 71 is in a free passage condition.
[0074] Therefore, although the drawing free passage way 81 may be open for free passage with the location of the main valve object 80 or it may intercept, since the main free passage way 71 is in a free passage condition, it can realize a full admission condition. If differential pressure **P arises, moreover, the differential pressure energization force (A1and**P) energized like the 1st example of the above in the direction which sits the main valve object 80 Although it sits down on the sheet bulb 70 and the main free passage way 71 is intercepted in

order to overcome energization **** (FSP1-FSP2) of a return spring 59 and an auxiliary spring 99 Since the differential pressure energization force (A2and**P) energized in the direction which sits the auxiliary valve object 90 is smaller than energization **** (FSP1-FSP2) of a return spring 59 and an auxiliary spring 99, the drawing free passage way 81 is open for free passage with as. Therefore, a half-opening condition is realizable.
[0075] Since it is the same as that of the 1st example of the above about the other actuation or the conditions searched for, it omits here.
[3rd example] drawing 6 is the sectional view showing the outline configuration of the solenoid valve which is the 3rd example of this invention.
[0076] Although the fundamental configuration is the same as the 1st example shown by drawing 1 etc., the following one place differs. That is, in the 1st example of the above, the cylindrical member 158 of non-magnetic material is infixed in the field where a plunger 50 counters a stopper 41 for the plate 58 of non-magnetic material immobilization or into the crevice where the return spring 59 is inserted in the **** 3 example although arranged free movable. And rather than the field where a plunger 50 counters a stopper 41, only a few projects and end-face 158a of this cylindrical member 158 is prepared. That is, since end-face 158a of this cylindrical member 158 is provided so that a plunger 50 may become closer to a stopper 41 than the field which counters a stopper 41, when a suction force with which it energizes to a solenoid 40 and a plunger 50 approaches a stopper 41 works, only end-face 158a of the cylindrical member 158 will be maintained where a stopper 41 is contacted.
[0077] If this is prepared like the 1st example in most fields where the plate 58 of non-magnetic material counters a stopper 41, it will become an inhibition factor in case both whom the surface tension by the so-called oil film etc. contacted when, as for close, both contacted [brake fluid] estrange between a plate 58 and a stopper 41, and it leads to lowering of the response of control. Therefore, if it is made only for end-face 158a of the cylindrical member 158 of non-magnetic material to contact a stopper 41, an inhibition factor in case both who contacted estrange will be reduced, and it will lead to improvement in the response of control.
[0078] As mentioned above, this invention is not limited to such an example at all, and can be carried out with the gestalt which becomes various in the range which does not deviate from the main point of this invention. For example, in each above-mentioned example, although the auxiliary valve object 90 and the auxiliary spring 99 were arranged to the interior by making the main valve object 80 tubed, the configuration of the main valve object 80 can adopt the shape of a semi-sphere etc. variously rather than is [for example,] cylindrical. Moreover, what produces the energization force in elasticity by adopting and compressing elastic bodies, such as rubber, instead of a return spring 59 and an auxiliary spring 99 may be adopted.
[0079] Moreover, although the above-mentioned example explained the case where a solenoid valve was applied as a boost control valve 21 in the antiskid-control equipment as a brake operating unit, it is applicable also to a traction control unit as what adjusts wheel damping force, for example by brake fluid pressure similarly.
[0080] Moreover, although the above-mentioned example described that a boost of a half-opening condition and the combination of maintenance perform a boost and ****** which was being performed with the combination of maintenance, only a boost of a half-opening condition may perform ******.

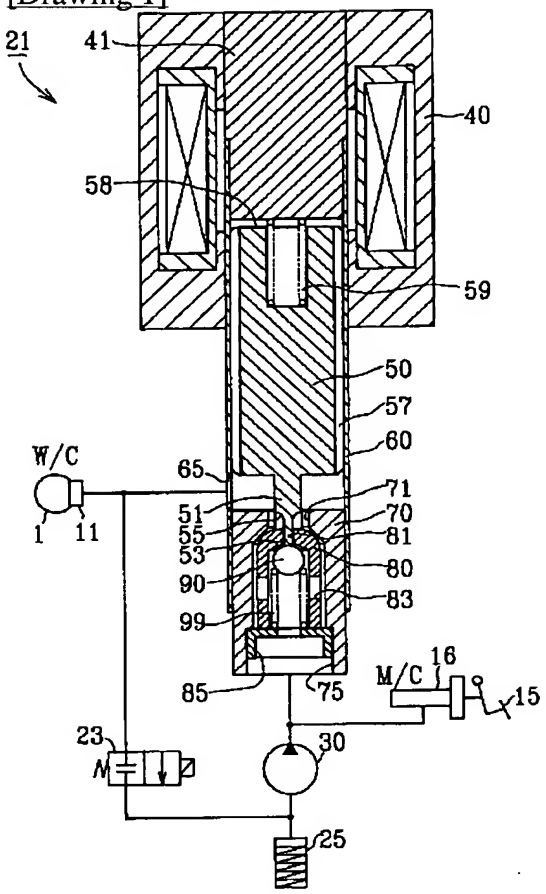
[Translation done.]

* NOTICES *

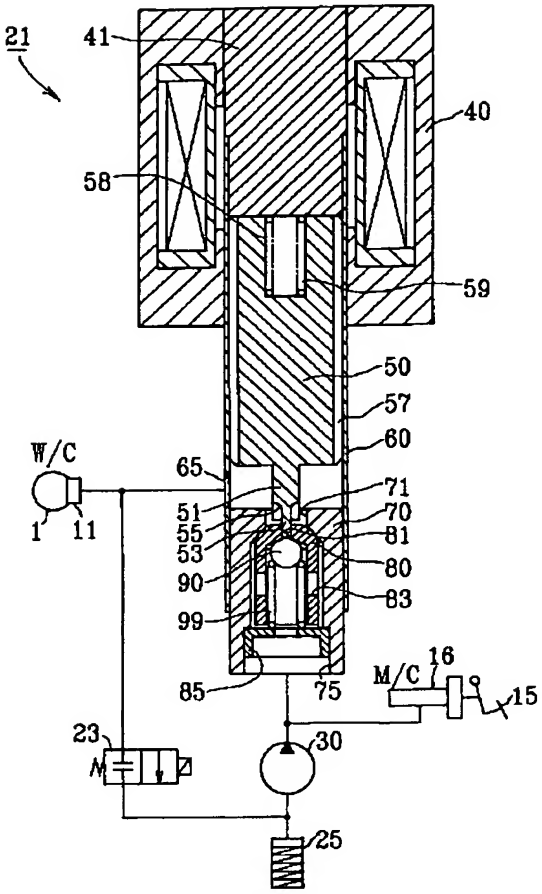
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

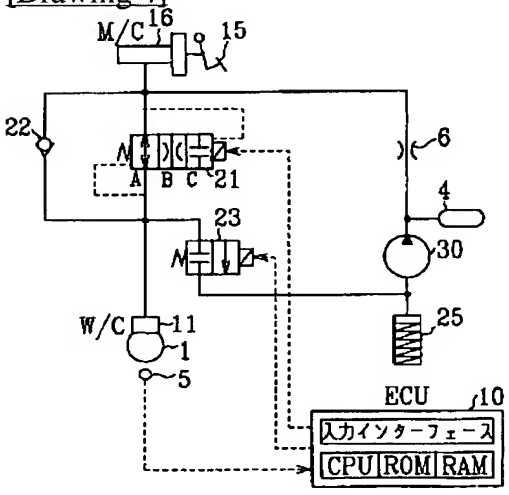
[Drawing 1]



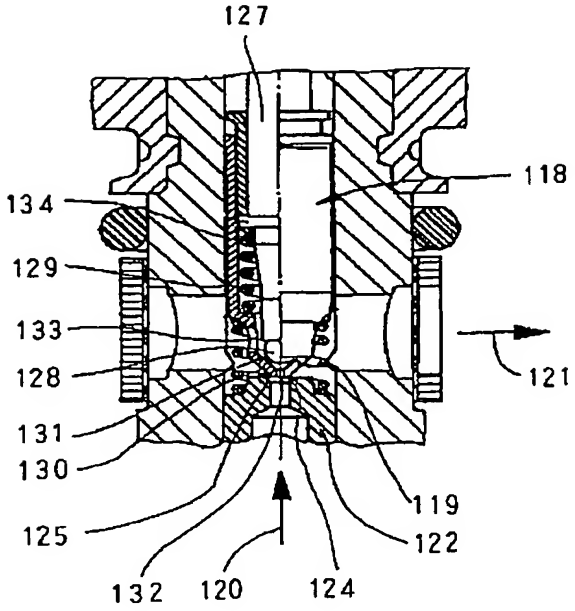
[Drawing 2]



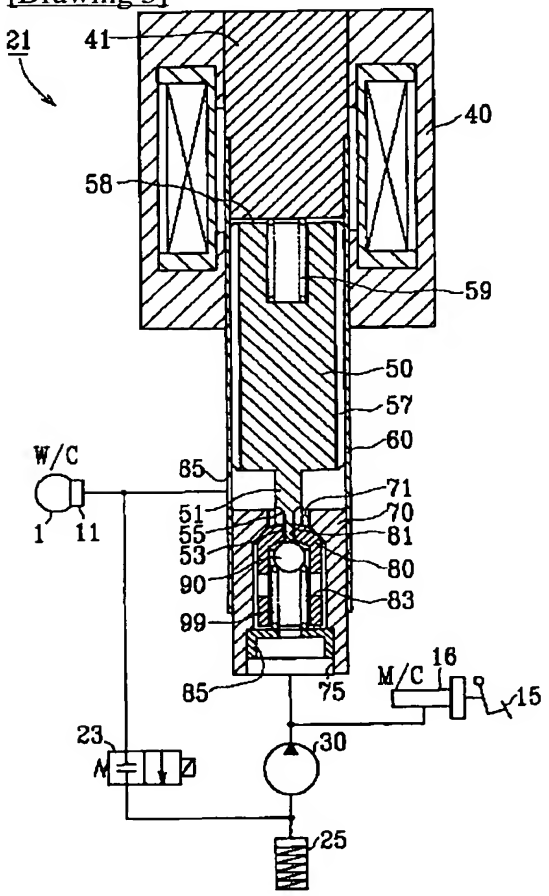
[Drawing 4]



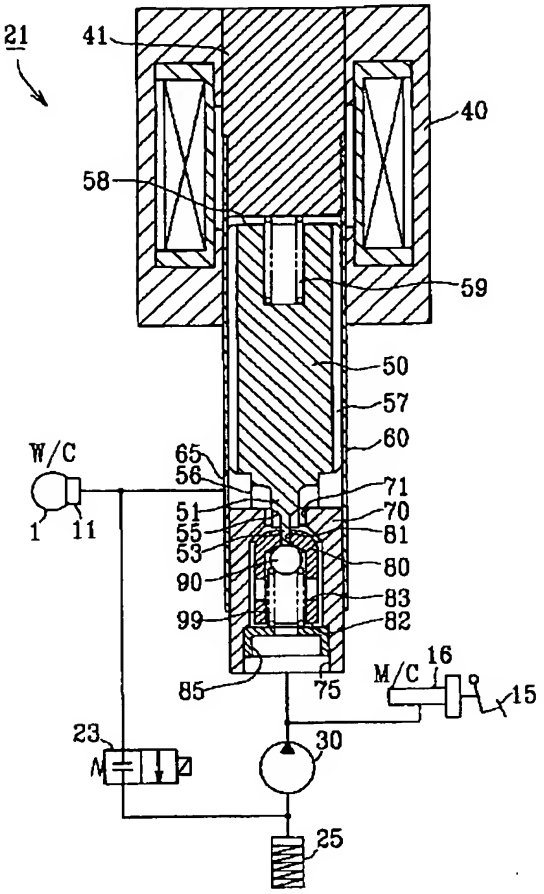
[Drawing 7]



[Drawing 3]



[Drawing 5]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W/C
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53
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90
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99
82
1
11
85
75
M/C
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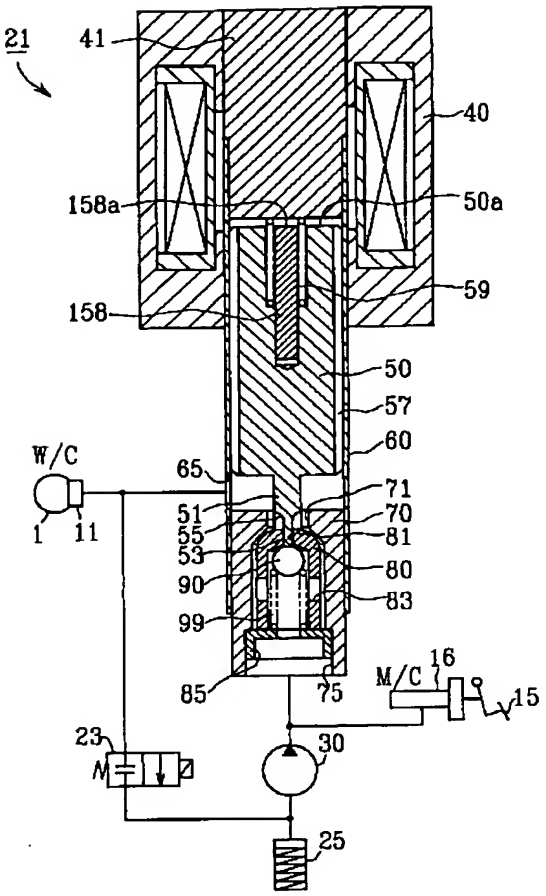
25

[Drawing 6]



[Translation done.]